UNIVERSITY OF LONDON.

INTERMEDIATE EXAMINATION IN ARTS, JULY, 1882.

1. Express $\sqrt{\frac{26.54 \times 0.004321}{0.00001357}}$ correctly to the nearest integer.

$=92$ nearly.

2. Prove that any number is divisible by 9 if the sum of its digits is divisible by 9. Prove also that a number is divisible by 11 if the sum of the odd digits (*i.e.* the 1st, 3rd, 5th, etc.) exceeds or is less than the sum of the even digits (*i.e.* the 2nd, 4th, 6th, etc.) by a number divisible by 11.

Bookwork. See Todhunter, articles 444, 445.

3. What must the rate of interest be that a sum of money may accumulate at compound interest to double its amount in 20 years?

$$R=2^{\frac{1}{20}} \quad \log R=\tfrac{1}{20} \log 2=.0150515.$$

By making use of the given log we find the required rate to be $3\frac{1}{2}$ per cent.

5. Reduce to their lowest terms

$$(a)\ \frac{ax+2}{2a+(a^2-4)x-2ax^2}$$

$$=\frac{ax+2}{(ax+2)(a-2x)}=\frac{1}{a-2x};$$

$$(b)\ \frac{x^4+5x^3+6x^2+5x+1}{x^4+3x^3-2x^2+3x+1}$$

$$=\frac{(x^2+4x+1)(x^2-x+1)}{(x^2+4x+1)(x^2+x+1)}=\frac{x^2+x+1}{x^2-x+1}.$$

7. The first term of a geometrical progression is a, and the tenth term is b, find the n^{th} term.

The tenth term $=ar^9=b$, $\therefore\ r=\left(\frac{b}{a}\right)^{\frac{1}{9}}$

$$n^{\text{th}} \text{ term}=ar^{n-1}=a\left(\frac{b}{a}\right)^{\frac{n-1}{9}}.$$

8. Solve the equation

$$\frac{2}{x^2+2x-2}+\frac{3}{x^2-2x+3}=\frac{x}{2}.$$

$$\frac{2x^2-4x+6+3x^2+6x-6}{x^4-4x^3+3x^2+6x-2x^2+4x-6}=\frac{x}{2}$$

$$\frac{5x+2}{x^4-3x^2+10x-6}=\frac{1}{2},\ x=0,$$

$$x^4-3x^2=10,\quad x^2=5 \text{ or } -2,$$

$$x=\pm\sqrt{5} \text{ or } \pm\sqrt{-2}$$

$$\therefore\ x=0;\ \pm\sqrt{5};\ \pm\sqrt{-2}.$$

9. The sum of the squares of two numbers is 650, and their product is 323; what are they?

Let $x=$ one number, $\frac{323}{x}=$ other number;

$$x^2+\left(\frac{323}{x}\right)^2=650,$$

$$x^4-650x^2=-104329$$

$$x^2-325=\pm 36$$

$$x^2=361 \text{ or } 289,$$

$$x=\pm 19 \text{ or } \pm 17.$$

10. What is the present worth of a perpetual annuity, £10 payable at the end of the first year, £11 at the end of the second, and so on, increasing £1 each year; interest being taken at 4 per cent.?

$$S=10\left\{\frac{1}{1.04}+\frac{1}{(1.04)^2}+\ldots.\right\}$$

$$+\frac{1}{(1.04)^2}+\frac{2}{(1.04)^3}+\ldots.=s_1+s_2, \text{ say}$$

$$s_1=10\cdot\frac{\frac{1}{1.04}}{1-\frac{1}{1.04}}=250,$$

$$s_2=\frac{1}{(1.04)^2}+\frac{2}{(1.04)^3}+\frac{3}{(1.04)^4}+\ldots$$

$$\frac{s_2}{(1.04)}=\frac{1}{(1.04)^3}+\frac{2}{(1.04)^4}+\ldots$$

$$\therefore\ s_2\left(1-\frac{1}{1.04}\right)=\frac{\frac{1}{(1.04)^2}}{1-\frac{1}{1.04}}$$

$$s_2=625,\ \therefore\ S=875.$$

CLASSICS.

G. H. Robinson, M.A., Whitby, Editor.

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